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JGR

Journal of Geophysical Research: Oceans

RESEARCH ARTICLE

10.1002/2015JC011062

Natural and unnatural oil slicks in the Gulf of Mexico

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Key Points:

- Background seepage contributes a steady surface flux of oil to the Gulf of Mexico
- The Deepwater Horizon discharge generated a dynamic surface slick of far greater size
- Response efforts coincided with decrease of floating volume, but increase in oil covered area

Global Cumulative coverage from SAR

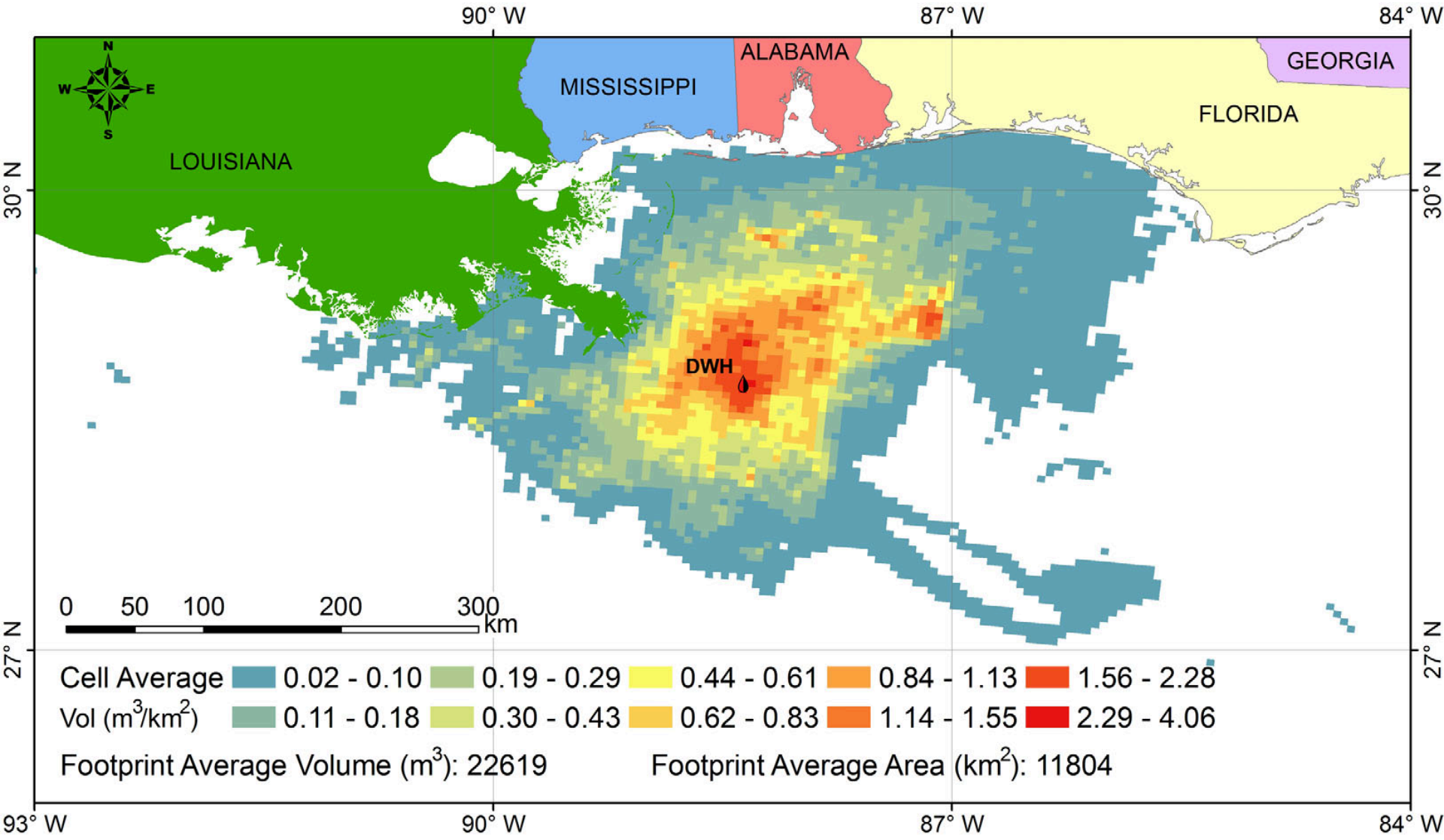

Figure 3. Map of surface oil from Deepwater Horizon: Distribution and average volume of surface oil (m3 km22) from DWH discharge; gridded at 5 3 5 km scale, across a cumulative footprint of 149,000 km2, 24 April 2010 to 3 August 2010.

Distance Map of Oil

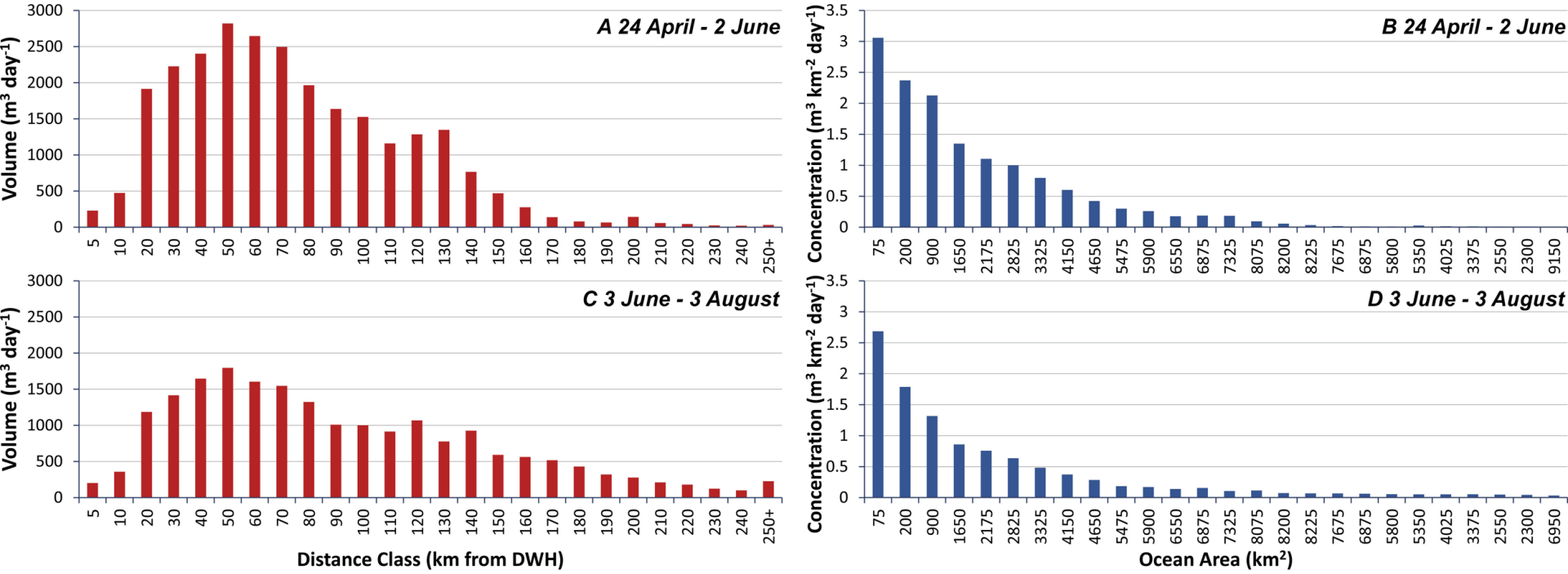

Figure 4. Surface oil magnitudes by distance from DWH: (a) Average volumes (m^3 d21) within surface oil footprint at progressive distances from the DWH accident site are shown for increments of distance 1–5, 5–10, and 20–30 km, etc. (a) Average concentrations of oil (m3 d21 km22) are shown within the increments of ocean area for distance classes in Figure 4a.

Oil Time Line

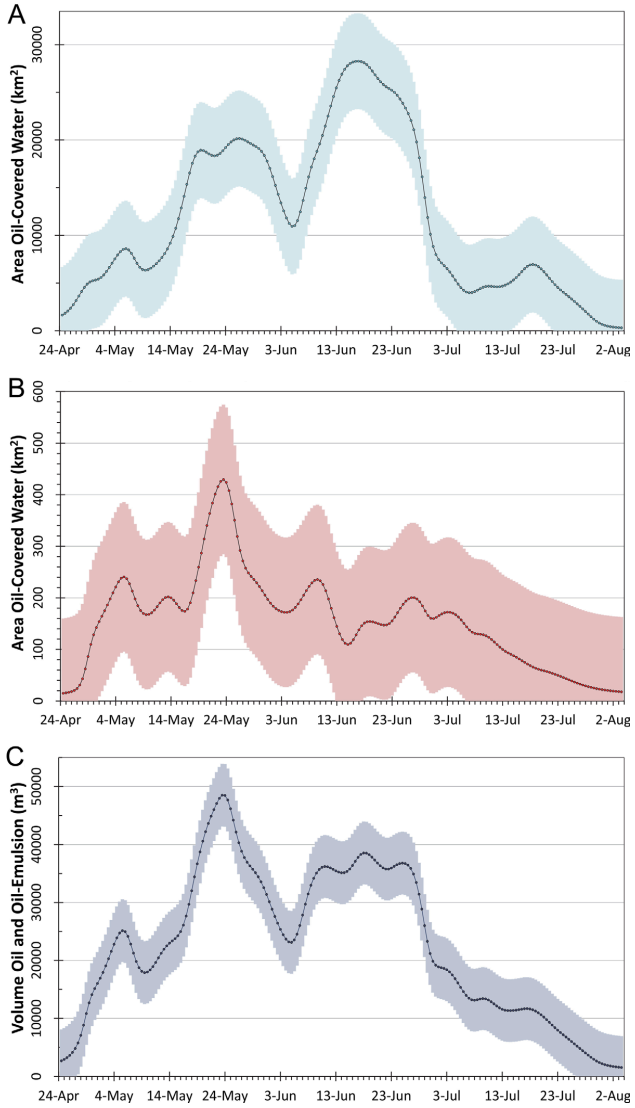

Figure 5. Time series of surface oil (area and volume) from DWH: (a) area of oil-covered water irrespective of oil thickness (km^2); outline shows confidence interval (61 SD). (b) Area of thick oil (70 mm) exclusively—note scale change (km^2); outline shows confidence interval (61 SD). (c) Combined volume of floating oil (m3); outline shows confidence interval (61 SD). For a region of the same area, thick oil constitutes a volume seventyfold greater than thin oil.

Table 2. Statistics of Surface Oil Variation During DWH: Summary Estimates Were Calculated for SAR Detected Oil Footprint Area and Volume During the Time Period 24 April 2010 to 3 August 2010[a]

	Peak Values			Summary Values		
Units	6 May	23 May	18 June	Average	Maximum	SD
Area (km^2)	8,500	18,900	28,100	11,800	28,200	5,028
Thick volume (m^3)	16,000	29,500	10,500	10,800	29,500	2,001
Total volume (m^3)	26,000	48,500	38,500	20,000	48,500	5,412
Total volume/area	2.90	2.57	1.37	1.80	5.04	0.4897

[a]Peak area and volume values for all surface oil occurred in May and June. Units of area, volume, and concentration are reported to three significant figures; standard deviation (no units) is reported to four significant figures.

Time History of Surface Oil

(a) Macondo Well blowout occurs
(b) DWH drillship sinks and release begins
(c) Aerial dispersant application begins
(d) Containment dome attempt fails; burning surface oil begins
(e) Subsea dispersant campaign begins (5 May)
(f) Flaring of recovered oil begins
(g) Top-kill attempt
(h) Riser cut from blow-out preventer; direct injection of subsea dispersant begins
(i) Hurricane Alex makes landfall
(j) Capping stack closure stops release
(k) Tropical Storm Bonnie makes landfall
(l) Well killed by static backfill.

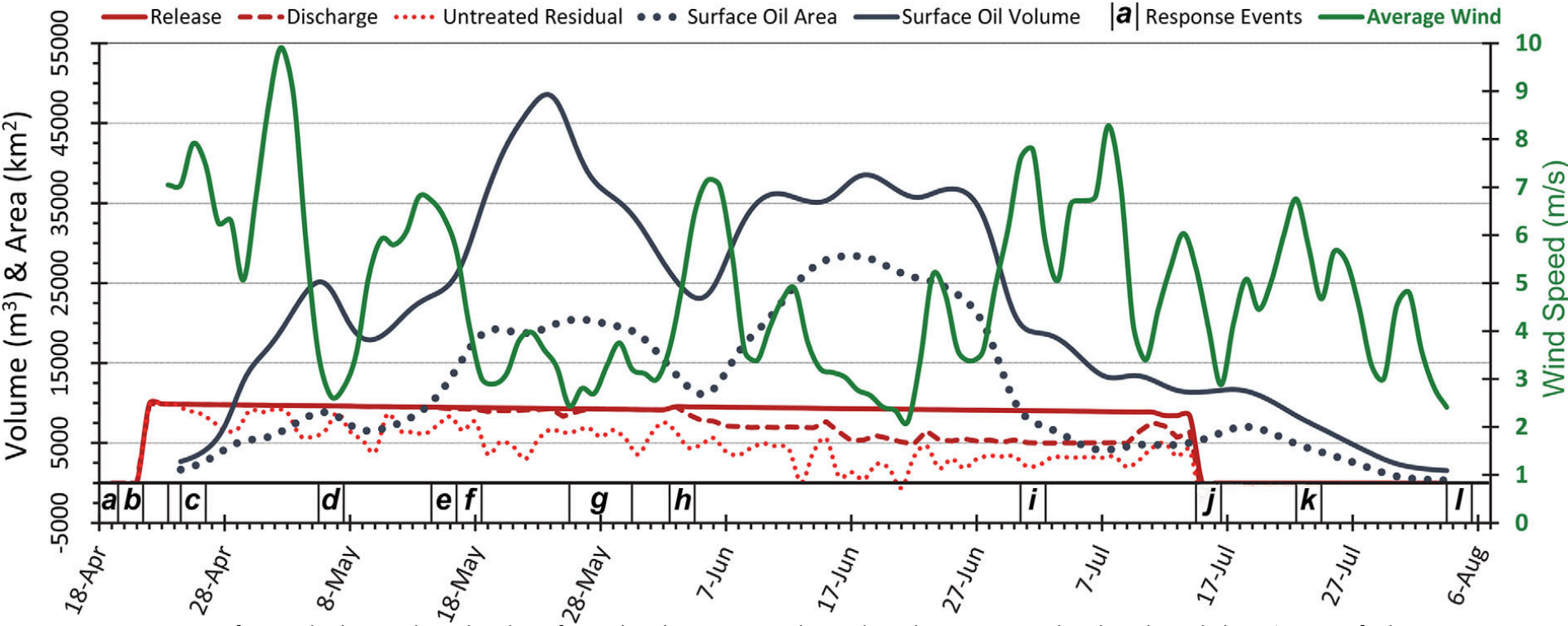

Figure 7. Time series of DWH discharge plotted with surface oil and average wind speeds. Release magnitudes show best daily estimates of oil escaping from the damaged well. Discharge subtracts the oil recovered from the gross release, while treatment further subtracts burned and dispersed by aerial and subsea applications of Corexit at maximum efficacy.

Takeaways

- Best Correlation was between winds and oil coverage

- After Seabed dispersants, oil spread over a larger area